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DEVELOPMENT OF PLANTATIONS ON CROWN LANDS

Planted 1977 Assessed 1987

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ABSTRACT

Sample plots established (in 1982) in 1977 plantations were remeasured in 1987. Height and diameter measurements from ninety eight sample plots were analysed to show height and diameter (dbh) of planted trees.

Measurements were also recorded for the height, diameter (dbh) and density of natural conifer reproduction and hardwood competition.

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INTRODUCTION

Monitoring plantation development with permanent sample plots commenced in 1980. Since that time plantations of most planted species, and all forest licenses have been sampled. However, not all species occur on each license.

To date planatations of White pine and Norway spruce have not been sampled.

The number of sample plots established totaled over 1 600 by 1987. Ninety eight plots established (in 1982) in 1977 plantations were remeasured in 1987.

The primary use of the data collected will be to provide yield information to support the wood supply analysis.

All measurement data was collected and analysed by the Timber Management Branch, Department of Natural Resources, Province of New Brunswick.

METHODS

Permanent sample plots of 8 metre radius (201 m^2 area) were established (in 1982) in 1977 plantations as suggested by Krause 1979[1]. Sample plots containing less than thirty one (31) planted trees were not remeasured in 1987.

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[1] H. H. Krause, 1979. Development and Yield Projections in Forest Plantations, A Proposal for Growth Monitoring in N.B. D.N.R. Plantations.

On each sample plot, planted trees were identified with aluminum tags and their height and diameter (dbh) was recorded. The height and diameter (dbh) of natural conifers more than 50 cm high was recorded by species. Diameters of less than 3.0 cm dbh were not recorded.

Hardwood species taller than one (1) metre were recorded on each 8 metre radius plot if fewer than 100 trees were present. When more than 100 trees were present, hardwoods were tallied on 4 subplots of 1.0 metre radius. Trees larger than 3.0 cm dbh were also recorded on the 8.0 metre radius plot in the latter case.

A soil pit was excavated near a sample plot to provide an estimate of soil drainage. A visual estimate of ground vegetation, slope and aspect were also recorded for the site.

Damage to planted trees was recorded both within and surrounding the sample plot according to its type, intensity and distribution. A more detailed account of methods can be obtained from the field manual.[1]

RESULTS

The average diameter of planted trees ten years after plantation establishment was 5.10 cm at breast height with a corresponding average height of 2.73 metres (Table 4). Jack pine was largest in height and diameter followed by black spruce and white spruce.

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[1] Instructions for Establishment of Sample Plots for 10th Year Plantation Development Assessment. Dept. of Natural Resources and Energy (1986).

The largest average diameter for jack pine (6.28 cm) was recorded on the Queens-Charlotte License. The poorest development of jack pine (4.51 cm dbh) occurred on the Lower Miramichi License. Black spruce showed its best development on the Carleton License and was poorest on the Queens-Charlotte License. White spruce was sampled only on the Restigouche-Tobique License and had an average diameter of 3.40 cm (Table 4).

Comparison of height growth with the 5th year plantation assessment data (Table 5) shows that jack pine paper pots have performed better than black spruce. No comparitive data was available for white spruce. Jack pine bare root stock showed greater height growth than jack pine paper pots over the period.

Natural softwoods contribute to plantation density both positively and negatively. Species such as black spruce were desireable where the density of planted stock was low due to poor survival. However, in many plantations excessive natural conifer invasion, especially balsam fir, was not considered beneficial because they create an over stocked condition requiring expensive spacing treatment. As well, balsam fir is highly susceptible to budworm damage. Table 6 shows that when total density was considered forty-two (42) percent of the sampled area had excessive stocking (ie. more than 3 000 trees per hectare) of conifers.

Another undesirable contribution to plantation stocking was excessive (more than 500 trees per hectare of trees above critical height) numbers of hardwood stems. This condition was present on thirty-two (32) percent of the sample area (Table 6). Natural hardwood densities up to seven thousand (7 000) trees per hectare were recorded (Table 1 & 2) on ninety-five (95) percent of the sample area.

SUMMARY

Crown Land plantations established in 1977 and remeasured in 1987 were meeting minimum density standards of 1 500 trees per hectare. Many plantations exceed the 5th year density criteria of 3 000 total stems (all species) per hectare.

Density of competing hardwoods was greater than 500 trees per hectare on one third of the sample area.

TABLE 1
DEVELOPMENT OF SELECTED 1977
BARE ROOT PLANTATIONS ASSESSED 1987
10TH YEAR REPORT

SILVICULTURE TREATMENT NUMBER	PLANTATION NAME	AREA HA.	PLANTED SOFTWOOD		ALL NATURAL SOFTWOOD			ACCEPTABLE[2] NATURAL SOFTWOOD			ALL NATURAL HARDWOOD			NATURAL HARDWOOD COMPETITION[3]		
			AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY[1]	AVG. HGT. (m)	AVG. DBH. (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)
101000477BP1	Charlo Camp	138	2.94	5.1	5023	1.88	4.0	99	3.09	3.6	398	1.72	-	-	-	-
101000477BP2	Charlo Camp	40	3.28	5.5	3233	1.60	4.4	50	3.40	5.3	-	-	-	-	-	-
406001277BP0	Pocologan	33	3.78	6.3	10594	1.86	3.6	0	-	-	696	2.02	-	-	-	-
510000777BP0	Quisibus River	204	1.12	-	2188	1.55	-	0	-	-	6901	3.08	3.8	6080	3.44	3.8
510000877BP1	Moose Valey Bk.	298	1.32	3.4	1094	2.56	4.3	50	1.94	-	3979	1.52	-	3979	1.52	-

1 DENSITY IN TREES PER HECTARE.
2 ACCEPTABLE IS DEFINED IN APPENDIX 9, PAGE 65 OF THE FOREST MANAGEMENT MANUAL. ALSO REFERRED TO AS CRITICAL HEIGHT.
3 COMPETITION INCLUDES ALL HARDWOODS EQUAL TO OR TALLER THAN ACCEPTABLE SOFTWOOD CRITICAL HEIGHT.

TABLE 2
DEVELOPMENT OF SELECTED 1977
PAPER POT PLANTATIONS ASSESSED 1987
10TH YEAR REPORT

SILVICULTURE TREATMENT NUMBER	PLANTATION NAME	AREA HA.	PLANTED SOFTWOOD		ALL NATURAL SOFTWOOD			ACCEPTABLE[2] NATURAL SOFTWOOD			ALL NATURAL HARDWOOD			NATURAL HARDWOOD COMPETITION[3]		
			AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY[1]	AVG. HGT. (m)	AVG. DBH. (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)
101T06777BP1	Charlo Camp	198	2.89	5.1	1753	1.22	4.8	12	4.55	8.1	87	2.27	6.7	12	4.72	6.7
101T00777BP2	Charlo Camp	122	2.25	4.1	4675	1.49	4.2	66	3.50	4.9	2122	3.30	4.4	713	4.58	4.4
102T00377BP0	Flemming Bk.	130	1.90	3.4	6	0.72	-	0	-	-	735	3.22	4.4	619	3.54	4.4
102T00477BP0	Nine Mile E.	116	1.89	3.7	1323	2.42	6.0	90	2.71	5.7	2566	4.08	5.8	2089	4.33	5.8
102T00677BP0	Forty-four Mi.Bk.	36	2.07	3.6	0	-	-	0	-	-	224	2.15	-	99	2.84	-
102T00977BP1	Lovall's Lake	151	4.09	6.1	1343	3.11	5.2	59	5.07	7.2	1786	4.71	7.1	407	6.76	7.4
102T00977BP2	Lovall's Lake	38	2.75	3.9	1376	3.25	5.4	66	3.46	4.1	1161	5.33	6.6	365	5.86	6.6
102T01077BP0	Bass River	17	2.46	3.4	696	2.21	4.8	99	4.11	5.7	746	1.95	3.7	99	3.42	3.7
203T01477BP0	Six Mile Bk.	191	3.26	4.5	2172	2.01	4.6	414	3.87	4.7	4170	1.38	-	0	-	-
206T01777BP1	Lower Otter Bk.	85	3.44	5.2	1691	1.34	6.6	50	5.35	9.4	0	-	-	0	-	-
206T01777BP2	Lower Otter Bk.	8	2.88	4.6	3747	1.82	4.2	531	3.33	4.2	99	1.27	-	0	-	-
306T02077BP0	Salmon River	136	1.51	4.0	3261	2.08	4.8	2238	2.59	4.9	2117	4.47	4.8	1016	5.64	4.8
307T02177BP0	Schools Dam	284	2.36	3.8	249	1.84	6.4	0	-	-	1069	1.47	-	199	2.91	-
406T02677BP0	Lee Settlement	47	3.30	4.9	50	1.90	-	0	-	-	162	1.76	4.3	25	3.60	4.3
406T03077BP0	McDougall Lake	4	3.32	4.6	99	1.69	-	0	-	-	5645	4.80	4.1	4451	4.93	4.1
406T03177BP0	Pocologan Sta.	117	3.06	4.6	227	1.29	4.4	6	4.35	4.4	1757	1.34	3.0	6	3.32	3.0
409T02277BP0	Napadogan Bk.	40	2.91	4.3	5065	1.61	4.2	0	-	-	663	3.03	4.1	141	5.43	4.1
409T02377BP0	Deersdale	127	4.21	6.2	4476	2.41	4.3	0	-	-	1144	2.15	3.5	17	5.05	3.5
510T01177BP2	Moose Valley Bk.	551	1.52	3.5	398	2.38	4.4	0	-	-	2139	1.71	3.3	460	2.70	3.3

1 DENSITY IN TREES PER HECTARE.
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3 COMPETITION INCLUDES ALL HARDWOODS EQUAL TO OR TALLER THAN ACCEPTABLE SOFTWOOD CRITICAL HEIGHT.

TABLE 3
SPECIES DEVELOPMENT OF SELECTED 1977
PLANTATIONS ASSESSED IN 1987
10TH YEAR REPORT

SILVICULTURE TREATMENT NO.	AREA (ha.)	PLANTED SOFTWOOD				METHOD OF SITE PREPARATION
		SPECIES	STOCK	HEIGHT(m)	D.B.H.(cm)	
101000477BP1	138	JP	BR	2.94	5.1	Shark Fin Barrels
101000477BP2	40	JP	BR	3.28	5.5	Shark Fin Barrels
101T00777BP1	198	JP	PP	2.89	5.1	Shark Fin Barrels
101T00777BP2	122	BS	PP	2.25	4.1	Shark Fin Barrels
102T00377BP0	130	BS	PP	1.90	3.4	Burn
102T00477BP0	116	BS	PP	1.69	3.7	Finnish Plough
102T00677BP0	36	BS	PP	2.07	3.6	Burn
102T00977BP1	151	JP	PP	4.09	6.1	Finnish Plough
102T00977BP2	38	BS	PP	2.75	3.9	Finnish Plough
102T01077BP0	17	BS	PP	2.46	3.4	Finnish Plough
203T01477BP0	191	JP	PP	3.26	4.5	Shark Fin Barrels
206T01777BP1	85	JP	PP	3.44	5.2	Disc Trencher
206T01777BP2	8	JP	PP	2.88	4.6	Crusher
306T02077BP0	136	BS	PP	1.31	3.3	Shark Fin Barrels
		JP	PP	3.21	4.2	Shark Fin Barrels
307T02177BP0	284	BS	PP	2.36	3.8	Shark Fin Barrels
406001277BP0	33	JP	BR	3.78	6.3	Disc Trencher
406T02677BP0	47	JP	PP	3.30	4.9	Disc Trencher
406T03077BP0	4	JP	PP	3.32	4.6	Disc Trencher
406T03177BP0	117	JP	PP	3.06	4.6	Disc Trencher
409T02277BP0	40	BS	PP	2.91	4.3	Shark Fin Barrels
409T02377BP0	127	JP	PP	4.21	6.2	Shark Fin Barrels
510000777BP0	204	WS	BR	1.12	-	Finnish Plough
510000877BP1	298	WS	BR	1.32	3.4	Root Rake
510001177BP2	551	BS	PP	1.52	3.5	Root Rake

PP = paper pot; BR = bare root;
JP = jack pine; BS = black spruce; WS = white spruce

TABLE 4
LICENSE AVERAGES OF SELECTED 1977 PLANTATIONS
TEN YEARS AFTER PLANTING

		PLANTED SOFTWOOD		BLACK SPRUCE		WHITE SPRUCE		JACK PINE	
LICENSE	STOCK TYPE	HGT. (M)	D.B.H. (CM)	HGT.	D.B.H.	HGT.	D.B.H.	HGT.	D.B.H.
UPSALQUITCH	BR	3.07	5.25	-	-	-	-	3.07	5.25
	PP	2.62	4.92	2.25	4.11	-	-	2.89	5.15
	AV.	2.74	5.02	2.25	4.11	-	-	2.96	5.18
NEPISIGUIT	PP	2.76	5.42	2.05	3.68	-	-	4.09	6.13
LOWER MIRAMICHI	PP	3.26	4.51	-	-	-	-	3.26	4.51
QUEENS-CHARLOTTE	BR	3.78	6.28	-	-	-	-	3.78	6.28
	PP	2.68	4.66	1.31	3.32	-	-	3.13	4.67
	AV.	2.72	4.75	1.31	3.32	-	-	3.16	4.77
FUNDY	PP	2.36	3.80	2.36	3.80	-	-	-	-
CARLETON	PP	3.61	5.55	2.91	4.26	-	-	4.21	6.20
RESTIGOUCHE-TOBIQUE	BR	1.17	3.40	-	-	1.17	3.40	-	-
	PP	1.52	3.49	1.52	3.49	-	-	-	-
	AV.	1.33	3.48	1.52	3.49	1.17	3.40	3.28	5.62
PROVINCE	BR	1.97	5.57	-	-	1.17	3.40	3.28	5.62
	PP	2.80	5.07	2.06	3.91	-	-	3.55	5.40
	AV.	2.73	5.10	2.06	3.91	1.17	3.40	3.53	5.41

Stock Types - BR = Bare Root, PP = Paper Pot

TABLE 5

COMPARISON OF HEIGHT GROWTH (m)
OF FIFTH AND TENTH YEAR ASSESSMENTS
BY SPECIES AND STOCK TYPE
FOR 1977 PLANTATIONS

ASSESSMENT PERIOD	BLACK SPRUCE		WHITE SPRUCE		JACK PINE	
	BR	PP	BR	PP	BR	PP
5 yrs.	0.58	0.75	-	-	1.36	1.16
10 yrs.	-	2.06	1.17	-	3.28	3.55
PERCENT INCREASE	-	175	-	-	141	206

TABLE 6

1977 PLANTATION PERFORMANCE BY LICENSE
TEN YEARS AFTER PLANTING

LICENSE	HECTARES SAMPLE	PERCENT OF AREA WITH ACCEPTABLE SOFTWOOD[1] DENSITY 1500 - 3000 TREES PER HECTARE	PERCENT OF AREA WITH HARDWOOD COMPETITION[2] MORE THAN 500 TREES PER HECTARE
UPSALQUITCH	498	100 (0)[3]	24
NEPISIGUIT	488	100 (100)	50
LOWER MIRAMICHI	191	100 (0)	0
QUEENS-CHARLOTTE	430	68 (39)	32
FUNDY	284	100 (100)	0
CARLETON	167	100 (0)	0
RESTIGOUCHE-TOBIQUE	1053	100 (81)	48
TOTAL	3111	96 (58)	32

[1]Acceptable softwood assumes a minimum of 1 500 planted trees and other softwoods except balsam fir which achieved critical height

[2]Competition includes all hardwoods equal to or taller than acceptable softwood critical height.

[3]Bracketed figures include balsam fir.